Acoustic Society members report new developments in voice-to-print conversion, semiconductor transducers. Future nonacoustic communications systems predicted include intercity waveguide systems

To appraise acoustics of an auditorium before it is built, Bell Labs processes music through a digital computer programmed to simulate auditorium effects. Processed signals are evaluated in anechoic chamber

Phonetic Typewriter Nears Practical Use

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CINCINNATI—Development of a phonetic typewriter—one which will print out spoken words—has progressed at Kyoto University, Japan (ELECTRONICS, p 87, May 27, 1960), to prototype.

One of the inventors, T. Sakai, reported at the Acoustical Society meeting here last month that the Sonotype will now handle any language. Early version could handle only 100 Japanese monosyllables.

Computer-type circuits are divided into three subsystems: a phoneme classifier, control and analysis systems. Control pulses are derived from the input speech sound wave. Distinctive features of speech sound are detected by spectrum analysis and phoneme recognition. Discrimination is made by digital techniques using order pulses, AND gates, OR gates and other binary circuits.

Bell Telephone Labs personnel discussed three new developments in semiconductor transducers.

One unit is similar to existing semiconductor strain gages, but gage sensitivity was increased to the point where output factors of 1,000 have been obtained. This was achieved by studying effects of doping levels, piezoresistive effect linearity and elastic properties as a function of size and orientation. Gages based on this information are free from temperature effects, elastic effects and finding stresses.

Semiconductor Transducers

Piezoelectric semiconductors with *p-n* junctions can generate ultrasonic waves. Absence of electrical carriers in the depletion region between the *p* and *n* layers will cause signal voltage applied across the gap to generate a wave whose magnitude is determined by the electromechanical coupling factor of the semiconductor. Thickness of the depletion layer can be controlled by varying the d-c bias used. Transducers respond to driving frequencies to 30 Gc.

The third transducer depends on the fact that the height and slope of the current-voltage curve in the positive resistance region of a tunnel diode is a function of the pressure applied to the device. Response is instantaneous and relatively good over a range of 0 to 20,000 psi. Extremely good sensitivity is obtained over restricted ranges.

Units can be made sensitive to differential pressures with proper biasing and can measure d-c pressures—a feat acoustic microphones cannot duplicate. Power output can equal piezoelectric crystals. If necessary, units only 1/1000-in. in diameter can be made. These easy to calibrate devices may provide probes for testing sound fields.

More sensitive devices may utilize the negative resistance retion of the tunnel diode curve. A positive resistance whose absolute value is about equal to the negative resistance could be shunted across the diode. A larger change in voltage with pressure is obtained because pressure controls the diode's amplifying characteristics.

Another Bell Labs' scientist, J. R. Pierce, was invited to talk on nonacoustical communications techniques. He prophesized about the future, both in his paper and in an exclusive interview with ELECTRONICS. Pierce emphasized the

need for higher information handling rates and the desirability in some instances of obtaining permanent records of conversations.

While digital systems exist for transmitting data over ordinary switched telephone circuits, a convenient office device for putting typewritten information into both man and machine-readable form will be needed within the next decade, he said. With such a system letters could be filed chronologically and file searches made by electronically scanning stored information. Pierce feels equipment of this type may come in three years.

Character recognition devices, although useful in certain applications such as sorting mail, are not the answer to the input problem of information storage and retrieval systems in general, according to Pierce. In the future practically all documents will be originally recorded in machine-readable form.

Pierce feels economical data transmission of computer, voice and video signals will come to pass through use of digital circuits. At present it is possible to send 1½ million pulses a second over a cable pair using pulse code modulation techniques, but wider band circuits are needed.

A possible solution is intercity waveguides which would transmit up to one billion pulses a second. This form of communication would be essentially noninterfering, so the same frequency allocations could be made in adjacent areas. More special-purpose digital equipment will be needed.

Speech Compression Systems

Speech compression systems reports took a complete afternoon. Among techniques described were low-bit rate digital speech communication using a two-way analysis/synthesis formant tracking technique and bandwidth compression of speech by spectrum sampling.

Design versus performance factors for speech compression systems were also analyzed. A semivocoder developed for the Air Force transmits telephone speech using a system of multiple analog vocoders fed from any phone line. Another paper outlined a narrow-band analog multiplexing arrangement which can accommodate three telephone semivocoders.